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WHC-EP-0513

Biological Assessment for Threatened and Endangered Wildlife Species

Related to CERCLA Characterization Activities

MAR 1993

DRAFT

Prepared for the U.S. Department of Energy
Office of Environmental Restoration and Waste Management

Westinghouse Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the U.S. Department of Energy under Contract DE-AC06-87RL10930

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1.0 INTRODUCTION

The U.S. Department of Energy's (DOE's) Hanford Site has been placed on the National Priorities List, which requires that it be remediated under the Comprehensive Environmental Response, Compensation, and Liability Act or Superfund. Potentially contaminated areas of the Hanford Site were grouped into operable units, and detailed characterization and investigation plans were formulated. The DOE Richland Field Office requested Westinghouse Hanford Company to conduct a biological assessment of the potential impact of these characterization activities on the threatened, endangered, and sensitive wildlife species of the Hanford Site for the U.S. Fish and Wildlife Service. Additional direction for Westinghouse Hanford Company compliances with wildlife protection can be found in the Environmental Compliance Manual (WHC 1988).

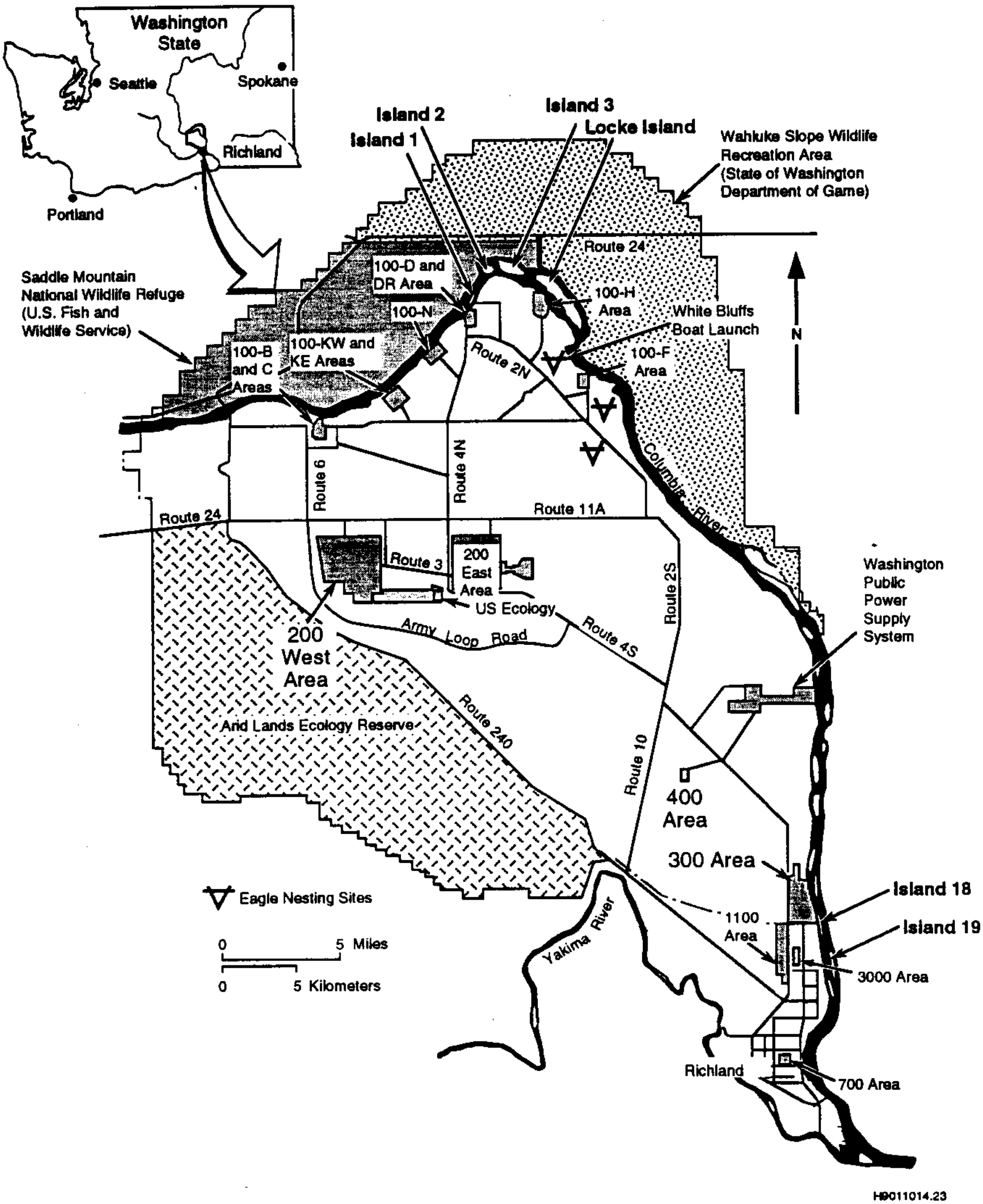
This report documents the biological assessment, which was conducted by Dr. R. E. Fitzner, a biologist at the Pacific Northwest Laboratory, Richland, Washington; S. G. Weiss, a biologist at Westinghouse Hanford Company; and J. A. Stegen, a summer intern in wildlife biology at Westinghouse Hanford Company. The pertinent components of the Hanford Site are briefly described as well as the planned characterization activities. Also provided are accounts of endangered, threatened, and federal candidate wildlife species on the Hanford Site and views of experts as to how human disturbances can affect these species. Potential effects of the characterization activities are described with recommendations for mitigation measures. A threatened and endangered plant survey has been conducted by Westinghouse Hanford Company and the Washington Department of Natural Resources (Washington Natural Heritage Program), as part of a vegetation survey of the 100 Areas (Sackschewsky 1992).

2.0 SITE DESCRIPTION

The Hanford Site is located in southcentral Washington State along the Columbia River near the city of Richland (Figure 2-1). Flow in the Columbia River is regulated by 11 dams within the United States: seven dams upstream from the Hanford Site and four dams downstream. The Hanford Reach, which extends for 83 km (52 mi) from Priest Rapids Dam to the head of Lake Wallula (created by McNary Dam), is the only stretch of the Columbia River within the United States above Bonneville Dam that is not impounded by a dam.

Between 1943 and 1963, nine water-cooled, graphite-moderated, plutonium production reactors were constructed by the U.S. government at the Hanford Site. Eight of the reactors are now retired from service (B, C, D, DR, F, H, KE, and KW); they have been declared surplus by the DOE and are available for decommissioning. The ninth, N Reactor, has also recently been declared retired.

Figure 2-1. Location of the Hanford Site and Eagle Nesting Sites.



Currently, more than 1,500 waste sites have been identified on the Hanford Site. These waste sites are grouped into four aggregate areas (100, 200, 300, and 1100) by the type of facility and operation. For example, the 100 Area consists of inactive nuclear reactor sites. Each area is further subdivided into operable units according to waste disposal practices, geology, hydrogeology, and other pertinent characteristics. These operable units will be considered source units (facilities that are potential sources of radiological or hazardous substance contamination) or groundwater units, which include the groundwater underlying the area. The following sections describe the facilities and operable units for the production reactor sites and the 200, 300, and 1100 Areas.

2.1 100-B/C AREA

The 100-B Area contains two reactors: B Reactor, which operated from 1944 through 1968, and C Reactor, operating from 1952 until 1969. The only active facilities in the 100-B Area are the 181-B Pumphouse, 182-B Water Reservoir and Pumphouse, 151-B Substation, and part of the water transport system. Of the 39 structures originally built, nine are still standing. Within the 100-B Area are five operable units: the source units 100-BC-1, 100-BC-2, 100-BC-3, and 100-BC-4; and the groundwater unit 100-BC-5. The 100-B Area lies on a flat bench south of the Columbia River and covers approximately 2.33 km^2 (0.93 mi^2). The elevation of the area ranges from approximately 149 m (490 ft) along the southern border to 131 m (430 ft) near the Columbia River. The average slope across the area is approximately 1%. Erosion has created a steep embankment that drops approximately 9 m (30 ft) to elevation 122 m (400 ft) along the Columbia River.

Surface soil around the reactors has been disturbed and reworked by construction activities. Two types of soil have been identified in and around this area, Ephrata Stony Loam and Burbank Loamy Sand. Ephrata Stony Loam has large hummocky ridges, made up of debris released from melting glaciers. Large boulders, several feet in diameter, are found between the hummocks. Burbank Loamy Sand has a dark-colored surface and coarse-textured subsoils underlain by gravel (Hajek 1966).

Significant topographic features near the 100-B Area include Gable Butte, which separates this area from the southern portion of the Hanford Site.

Vegetation within the 100-B Area includes a thick stand of willow (Salix spp.) upstream along the western shoreline; white mulberries (Morus alba), elms (Ulmus pumila), and junipers (Juniperus scopulorum) downstream; and mostly cheatgrass (Bromus tectorum), Russian thistle (Salsola kali) and tumblemustard (Sisymbrium altissimum) inside the 100-B/C Area fences (Sackschewsky 1992).

2.2 100-D AREA

The 100-D Area contains the D and DR Reactors and their operational support facilities. The D Reactor operated from 1944 to 1967, and the DR Reactor operated from 1950 to 1964. Most of the ground facilities have undergone some degree of decommissioning and in many instances have been demolished. Twenty of the original buildings are still standing. The 100-D Area is located approximately 2.4 km (1.5 mi) east-northeast of the 100-N Area and covers approximately 2.6 km^2 (1.0 mi^2). The area contains four operable units: three source units (100-DR-1, 100-DR-2, and 100-DR-3) and one groundwater unit (100-HR-3). The 100-D Area is situated on an essentially flat, semiarid bench immediately southeast of the Columbia River. The elevation of the land surface near the center of the area is approximately 142 m (466 ft) above mean sea level (amsl), with land surface sloping to the northeast (about a 1% gradient) to an elevation of approximately 134 m (440 ft). A steep embankment of about 18 m (60 ft) is present at the river's edge along the northwestern margin of the unit. The area around the production reactor area has been extensively disturbed; therefore, the surface is relatively flat.

Ephrata Stony Loam is one type of soil found in this area. The soil contains large hummocky ridges, with large boulders between the hummocks. Burbank Loamy Sand, Ephrata Sandy Loam, and Rupert Sand have also been identified in this area. Burbank Loamy Sand is dark colored, and the subsoil is coarse textured, underlain with gravel. Ephrata Sandy Loam is also dark colored with a subsoil that is medium-textured soil, underlain by gravel. Rupert Sand is a coarse-sand, alluvial deposit (Hajek 1966).

The shoreline adjacent to the 100-D Area contains a large stand of mature elm (Ulmus pumila) trees, surrounded by cheatgrass (Bromus tectorum), sand dropseed (Sporobolus cryptandrus), and tumblemustard (Sisymbrium altissimum). The northeast corner of 100-D Area is a mixed community dominated by big sagebrush (Artemisia tridentata). There are two abandoned apricot orchards and a considerable amount of cheatgrass (Bromus tectorum) in this area. To the east of the 100-D Area is a very sandy, dune-type community dominated by sagebrush (Artemisia spp.) and gray rabbitbrush (Chyrothamnus nauseosus) (Sackschewsky 1992).

In the center of the Columbia River just north of the area is a small island approximately 0.4 km (0.2 mi) long and up to 0.15 km (0.1 mi) wide.

2.3 100-F AREA

The 100-F Area has one reactor that was operational from 1945 through 1965. Additionally, from 1945 to 1976, laboratory research on plants and animals was conducted in the area. Most of the facilities associated with the reactor were retired in 1965. Currently, three of the original facilities have not been decontaminated and decommissioned. The two source operable units in the 100-F Area are 100-FR-1 and 100-FR-2. The 100-F Area covers approximately 7.4 km^2 (2.9 mi^2) and lies in a broad, essentially flat, semiarid plain on the eastern portion of a bend in the Columbia River. Elevation is approximately 122 m (400 ft) across the entire area. The river bank, which forms the northeast boundary of the area, drops steeply, approximately 9 m (30 ft).

The soil in this area has been extensively disturbed by construction activities. Pasco Silt Loam, Burbank Loamy Sand, and Ephrata Sandy Loam have been identified around this area. The Pasco Silt Loam has fine sandy loam and clay with variable subsoil consisting of stratified layers. Both Burbank Loamy Sand and Ephrata Sandy Loam have a dark-colored surface soil, with Burbank subsoil having a coarse texture and Ephrata subsoil having a medium texture. Both subsoils are underlain by gravel (Hajek 1966).

The vegetation in this area is mainly dominated by cheatgrass (Bromus tectorum) with some interspersed rabbitbrush (Chrysothamnus spp.) and sagebrush (Artemisia spp.). Studies are being conducted to better define the plant species in this area.

2.4 100-H AREA

The 100-H Area was used from 1949 to 1965 to produce plutonium for nuclear weapons. These operations resulted in the release of chemical and radioactive wastes into the soil, air, and water. The H Reactor and most of the operational support facilities have undergone some degree of decommissioning, and in many instances the facilities no longer exist. For cleanup purposes, the 100-H Area has been divided among three operable units: 100-HR-1, 100-HR-2, and 100-HR-3. The groundwater unit, 100-HR-3, is under the H and D Reactor areas and covers an area approximately 23 km^2 (9 mi^2). The other two operable units (100-HR-1 and 100-HR-2) cover approximately 5.86 km^2 (2.26 mi^2). The 100-H Area is on a semiarid bench, with elevation ranging from 116 to 140 m (380 to 460 ft) amsl. The land surface slopes downward gradually (about 1% gradient) toward the Columbia River, with an embankment of up to 9 m (30 ft) at the river's edge. Small groundwater seeps have been observed along this stretch of the river.

At least two different types of soil have been identified in and around the 100-H Area. Burbank Loamy Sand has a dark-colored surface, and the subsoil is coarse textured and underlain by gravel. The surface soil can range from 41 to 76 cm (16 to 30 in.) deep. The ground has been extensively disturbed from construction activities; consequently, the depth and content of surface soils vary. River-wash consisting of sand, gravel, and boulder deposits is also scattered along the shore of this area (Hajek 1966).

The 100-H Area contains two stands of black locust (Robinia pseudo-acacia). Between the stands of trees is a cheatgrass/tumblemustard community with several large giant wildrye (Elymus cinereus) individuals. The shoreline is dominated by reed canarygrass (Phalaris arundinacea) and bluegrass (Poa spp.). Much of the remaining area within 100-H is dominated by gray rabbitbrush (Chyrothamnus nauseosus) and cheatgrass (Bromus tectorum) (Sackschewsky 1992).

2.5 100-K AREA

The 100-K Area has two reactors, KW and KE. The KW Reactor operated from 1955 through 1970, and the KE Reactor operated from 1955 until 1971. Of the original 49 structures, 16 are still active, and 3 have been completely demolished or partially dismantled. The 100-K Area has four operable units: the 100-K-1, 100-K-2, and 100-K-3 source operable units, and the 100-K-4 groundwater unit. The source units cover approximately 1.89 km^2 (0.74 mi^2), with 100-K-4 extending more than 2.5 km (1 mi) downriver of the reactors. The source units are 152 to 305 m (500 to 1,000 ft) from the Columbia River. Ground elevation in this area varies from 122 to 152 m (400 to 500 ft) amsl, with a land surface slope averaging about 5% toward the northwest boundary.

The elevation in the area around the production reactors is relatively level because the surface has been extensively reworked during construction activities. Ephrata Stony Loam, Ephrata Sandy Loam, and Burbank Loamy Sand have been identified in and around this area. Ephrata Stony Loam contains large hummocky ridges in the soil, with large boulders between the hummocks. Ephrata Sandy Loam and Burbank Loamy Sand are dark colored, with a medium- (Ephrata Sandy Loam) to coarse- (Burbank Loamy Sand) textured subsoil, underlain by gravel (Hajek 1966).

The 100-K Area is mostly dominated by cheatgrass (Bromus tectorum) with some stands of sagebrush (Artemisia spp.) and Sandberg's bluegrass (Poa sandbergii). Studies are currently being conducted to further define the plant species present in this area.

2.6 100-N AREA

The 100-N Area contains one reactor, the last to be constructed as a major production reactor at the Hanford Site. The N Reactor went into production in December 1963 and operated on a continuous basis until December 1987 when it was placed on standby status. In 1988, it was placed on cold standby; it received retirement notice in 1991. The N Reactor differs from the other reactors on the Hanford Site in that it was designed as a dual-purpose reactor. The N Reactor was capable of producing special nuclear materials in addition to electricity from steam production.

The 100-N Area contains three operable units: 100-NR-1, 100-NR-2, and 100-NR-3. The 100-N Area covers 650 acres, with the 100-D Area on the northeast boundary and the Columbia River on the northwest boundary. Elevations in the 100-N Area range from 119 m (390 ft) amsl at the Columbia River to approximately 135 m (450 ft) amsl on the east side of the area.

Most of the ground surface has been extensively reworked as part of construction of the reactor buildings and related facilities. This ground disturbance allowed for the invasion of cheatgrass (Bromus tectorum), which is now the dominate vegetation in the area. Studies are currently being conducted to get a more complete species list for this area.

The surface is relatively flat and disturbed with an elevation of approximately 135 m (450 ft) amsl. The 100-N Area is surrounded by hummocky terrain, which is perhaps the result of catastrophic flooding associated with Pleistocene glaciation. Areas between the hummocks contain large boulders several feet in diameter and Ephrata Sandy Loam, which has a dark color with a medium-textured subsoil, underlain by gravel (Hajek 1966).

2.7 200 AREA

The primary function of the 200 Area was to process irradiated fuel for separation and recovery of desirable isotopes such as plutonium and uranium. The 200 Area is divided into the 200-East, the 200-West, and the 200-North areas. The 200-East Area covers approximately 20 km^2 (7.68 mi^2); 200-West is approximately 23 km^2 (8.9 mi^2); and 200-North is about 3.5 km^2 (1.5 mi^2). The 200 Area is divided into 43 operable units. It lies on a terrace known as the 200 Area Plateau. The elevation ranges from 190 to 245 m (623 to 803 ft) amsl. The terrace decreases in elevation to the north, northwest, and east toward the Columbia River, sloping steeply, with elevation changes between 16 and 33 m (50 and 100 ft).

The surface of the 200 Areas has undergone minimal erosion since its formation by floodwaters 13,000 years ago. The surface is veneered with loess and sand dunes of varying thickness (Hajek 1966).

The 200 Area plateau is characterized by native shrub-steppe interspersed with large areas of disturbed ground. The dominant shrub is big sagebrush (Artemisia tridentata) with the understory dominated by the native Sandberg's bluegrass (Poa sandbergii) and cheatgrass (Bromus tectorum). The vegetation in and around the ponds and ditches on the 200 Area Plateau is significantly different from that of the surrounding dryland areas. Several tree species are present, especially cottonwood (Populus trichocarpa) and willow (Salix spp.).

2.8 300 AREA

In 1943, construction began on a fuel fabrication complex in the 300 Area. In the early 1950s, construction began on research and development facilities. As the reactors shut down in the mid-1960s, fuel fabrication activities decreased and research activities increased.

The 300 Area contains four operable units: 300-FF-1, 300-FF-2, 300-FF-3, and 300-FF-5. (The Fast Flux Test Facility in the 400 Area is the 300-FF-4 operable unit and is separated geographically from the 300 Area.) The 300 Area lies within the regional topographic low of the Pasco Syncline, a broad depression in the southeastern portion of the Pasco Basin. The elevation of the area is from 116 to 119 m (380 to 390 ft) amsl. Surface topography in the area is generally flat and slightly irregular. The land slopes downward gradually to the east and south. There is a steep embankment at the river's edge of approximately 12 m (40 ft). Small groundwater seeps are found along this embankment.

A thin veneer of fine- to coarse-grained Eolian sand deposits covers most of the 300 Area. The thickness of these deposits varies, ranging from 0 to 4.6 m (0 to 15 ft). Many of these deposits were removed during construction activities. The subsoil is medium-textured soil, which is underlain by gravelly material and may continue for many feet (Hajek 1966).

The 300 Area is characterized by bitterbrush/sagebrush with some areas being primarily cheatgrass (Bromus tectorum).

2.9 600 AREA

All of the Hanford Site not included in other areas is considered the 600 Area. This area includes the Arid Lands Ecology Reserve; the "North Slope," leased to the state of Washington and U.S. Fish and Wildlife Service for wildlife refuges; the Washington Public Power Supply System; and two abandoned townsites. While some of the 600 Area DOE facilities were generators of radioactive waste, some were involved in waste management operations. In many cases, waste sites in the 600 Area are low priority when compared to other sites at Hanford. The waste site classification include hazardous waste, radioactive waste, municipal landfill, and site services. For this report, the 600 Area waste sites are considered as part of the nearest 100, 200, or 300 area operable units.

2.10 1100 AREA

The 1100 Aggregate Area is subdivided into three operable units: 1100-EM-1, 1100-EM-2, and 1100-EM-3. This area has been used as a maintenance area, warehouse facility, and equipment storage yard in support of operations at the Hanford Site. It is approximately 0.8 km (0.5 mi) west of the north Richland well field. The area is largely industrial; however, in parts of the area, such as the old Horn Rapids landfill, natural and introduced vegetation have become established.

The 1100 Area lies on an elongated north-south plateau at an elevation of approximately 122 m (400 ft) amsl. The land surface slopes generally to the southwest toward the Yakima River and to the east toward the Columbia River. The area is characterized by southwest-trending sand dunes with low to moderate relief. The dunes are up to 3 m (10 ft) thick and are largely stabilized by vegetation or have been reworked by grading and excavation for facilities. Surficial deposits consist primarily of eolian sands and silts.

Vegetation in this area has been historically defined as the bitterbrush/ sagebrush/Sandberg's bluegrass climax community, but most of the vegetation has been reworked and the area is covered with asphalt.

3.0 CHARACTERIZATION ACTIVITIES

Operable unit characterization activities include intrusive, nonintrusive, and other types of activities for the 100 Area production reactor sites, 200 Areas, 300 Area, and 1100 Area. Activities may be conducted in stages, consisting of source evaluation and nonintrusive surveys; source sampling and test pit soil sampling; and additional work based on preceding sampling efforts. Timing of these activities will depend on the availability of equipment and coordination of schedules. The weather and time of year can also limit some of these activities. Characterization activities planned for each area are listed by task in Table 3-1.

3.1 NONINTRUSIVE ACTIVITIES

Nonintrusive activities include topographic mapping, surface radiation surveys, ground-penetrating radar surveys, electromagnetic induction/magnetometer (EMI/MAG) surveys, process effluent pipeline integrity assessments, soil and sediment sampling, soil gas surveys, geologic investigations, and surfacewater and sediment sampling. The amount of time spent on these activities will vary depending on the location and size of the area where the activities will be conducted.

3.1.1 Topographic Mapping

Site maps of the operable units will be established from aerial photographs. No field activities will be conducted for this task.

3.1.2 Surface Radiation Survey

The surface radiation survey will locate any areas of elevated radiation in the surface soil. This survey will be conducted for selected areas and shorelines. This activity involves a three- to five-person crew and one to two vehicles. In each area, 61-m^2 (200-ft^2) grids will be established and the crew will walk throughout the grid on 8-m (25-ft) transects, using Ultrasonic Ranging and Data System (USRADS) equipment (carried in a backpack). This activity can take up to 3 months for an operable unit.

Table 3-1. Characterization Activities.

Activities	Areas								
	B	D	F	H	K	N	200	300	1100
Task 2 - Source Investigations[a]	X	X	X	X	X	X	X	X	X
Topographic mapping	X	X	X	X	X	X	X	X	X
Surface and shoreline radiation survey	X	X	X	X	X	X	X	X	X
EMI/MAG survey	X	X	X	X	X	X	X	X	X
Ground-penetrating radar survey	X	X	X	X	X	X	X	X	X
Process effluent pipeline integrity assessment				X					
Soil gas survey	X	X	X	X	X	X	X	X	X
Geologic investigations	X	X	X	X	X	X	X	X	X
Surface water and sediment investigations	X	X	X	X	X	X	X	X	X
Surface water and sediment sampling	X	X	X	X	X	X		X	X
Vadose investigation	X	X	X	X	X	X	X	X	X
Test pit samples[b]		5							
Borehole soil samples[b]	48	17	8	8	7	10	31	51	
Groundwater investigations	X	X	X	X	X	X	X	X	X
Welling drilling and sampling[b]	9	12	4	10	7	2	9	31	
Air investigation	X	X	X	X	X	X	X	X	X
Ecological investigation	X	X	X	X	X	X	X	X	X
Cultural resources investigation	X	X	X	X	X	X	X	X	X

[a]Task 1, Project Management, is not included.
[b]The numbers in these rows represent the approximate number of test pits, vadose boreholes, and groundwater wells that are planned to be drilled in each area. The location and number of drill sites will be modified during rescoping of the work plans.

3.1.3 Ground-Penetrating Radar Survey

This activity will determine the locations and boundaries of solid waste landfills, cribs, and other buried features that are currently uncertain, and other facilities that are not yet adequately identified. This survey will be conducted in the operable unit areas, on an as needed basis. It will involve a two- to three-person crew, and take 3 to 7 days per unit. An antenna, 0.19 m^2 (2 ft^2), weighing approximately 13.62 kg (30 lb) will be hand drug along transects in the area. Each area will have different transect dimensions, depending on the type of facility that needs to be identified.

3.1.4 Electromagnetic Induction/Magnetometer Survey

The objective of the EMI/MAG survey is to screen large areas for potential contamination for subsequent sampling and to precisely locate buried facilities. EMI equipment measures the electrical conductivity of subsurface materials. Magnetometer equipment detects ferronickel metallic objects, such as pipelines, buried beneath the surface. Both types of equipment are hand-held. The MAG survey will be primarily used to look for unknown subsurface pipelines and to better define the locations of known pipelines. When there is uncertainty in the location or the location is not well defined, the EMI survey will be conducted. For small facilities, the EMI survey will be conducted on a grid on 3-m (10-ft) intervals. For the larger facilities, the EMI survey will be conducted on 7.6-m (25-ft) intervals to determine the length and the width of the facility. These activities will involve two- to four-person crews.

3.1.5 Process Effluent and Discharge Pipeline Integrity Assessment

This activity will involve inspecting pipelines for breaches where leaks may have occurred. Some process effluent pipelines will be inspected by a remote camera, gaining access through an expansion box. This activity will range from 2 to 4 weeks, depending on the configuration and length of the pipelines. During this time, three to six people will be on the site, with up to four to five vehicles. A 5- by 6-m (17- by 20-ft) greenhouse will be placed over the expansion box opening to keep contaminants from spreading. This greenhouse will be moved to the pipelines being investigated as the inspection continues. The task will take place between March and November to take advantage of good weather conditions. Initially, the assessment will only be conducted in the 100-H Area. The results will determine if process effluent pipelines and discharge pipelines will be inspected in other areas.

3.1.6 Soil and Sediment Sampling

This activity will include collecting samples to determine if hazardous or radioactive substances are present. The sampling will be conducted for liquids, sludge, some building materials, and materials deposited on soils. Possible sampling methods include sampling thief, sampling trier, hand augers, Veihmeyer sampler, scoop/spade/shovel, hand corer, and the soil/sediment punch. This activity will generally last 1 day per activity location and involve one to three samplers.

3.1.7 Soil Gas Survey

Soil gas surveys will be conducted to identify areas where petroleum products or organic solvents may have been released. A two- to three-person crew will hammer probes into the soil at selected areas to extract soil gas. Probes for the soil gas survey will be installed on a grid with about 7.6-m (25-ft) intervals, to about 1- to 2-m (3- to 7-ft) depth at all locations. A hand-held pump will then retrieve the samples out of the probes. The sample will then be taken to a portable laboratory in a trailer that will be set up near the site being sampled.

3.1.8 Geologic Investigations

This task will further characterize the geologic structure and stratigraphy of the area. It will include data compilation associated with geologic and vadose zone soils, and mapping of all operable units. The mapping is planned for June through September and will involve two to three people.

3.1.9 Surface-Water and Sediment Sampling

This sampling will assess the impact of past facility operations and waste disposal activities on the quality of Columbia River water and sediment. Sampling will take place on and near the shoreline and from active springs or seepage areas. Sampling will coincide with low flow conditions from late summer to early winter. Sampling involves four to five people in the field for approximately 10 days.

3.2 INTRUSIVE ACTIVITIES

Intrusive activities include test-pit soil sampling and borehole and well drilling.

3.2.1 Trenches and Test Pit Soil Sampling

Trenches and test pits are open shallow excavations, typically longitudinal (if a trench) or rectangular (if a pit) to determine the shallow subsurface sonditions for engineering, geological, and soil chemistry exploration and/or sampling purposes. These pits are excavated manually or by machine, such as a backhoe. Samples are taken typically from materials in the equipment bucket.

Test pits normally have a minimum cross-section of 1.2 to 3.0 m (4 to 10 ft) square; test trenches are usually a minimum of 1 to 2 m (3 to 6 ft) wide and may be extended for any length required to reveal conditions along a specific line. The depths of trenches and test pits are expected to vary, depending on the waste unit being characterized. The maximum depth is not expected to exceed 9.1 m (30 ft). Duration of this activity depends on the size of the waste unit and the type of equipment used, and may occur at any time of the year.

3.2.2 Borehole and Well Drilling

Vadose boreholes and ground water monitoring wells willbe drilled using similar techniques. It is expected that there will be more than one technique used in drilling the boreholes an dwells. Cable-tool driling is to be the predominate method used in the 100 Areas. The diamond core method will be used when drilling through structural materials, such as concrete.

Measurements were taken that showed drill rig noise is predominantly impulse/ impact-type, with some intermittent noise from the diesel-powered drill rig. Measurements indicated that total noise exposures to the drill rig crew immediately around the well head [within 6 m (20 ft) of the borehole] exceeded 85 dBA. Noise exposure outside this zone was below 85 dBA. The maximum peak noise level measured next to the borehole was 129 dBA. Diesel engine noise was typically 70 dBA at a distance of 6 m (20 ft) from the borehole.

Borehole soil sampling will be used to determine the nature of vertical and horizontal distribution of contamination present in the vadose zone soils, determine the physical characteristics of the soils, and evaluate contamination movement. Around the borehole location, an area approximately 9 m^2 (100 ft^2) will be cleared of all vegetation. There will usually be one drill rig and a trailer at each site, along with a few smaller vehicles. The average vadose borehole is 9 to 15 m (30 to 50 ft) deep. Activity at drill sites varies, ranging for 2 weeks to 2 mo. There will be five to ten people at drill sites, depending on where the drilling is taking place (about five for sites away from the waste disposal area, ten when drilling through radiation zones). A 0.09 m^2 (1-ft^2) cement pad is left in place upon completion of a vadose borehole.

Groundwater wells will be drilled to test for the distribution and concentration of groundwater contaminants and evaluate movement into and beneath the Columbia River. Three to 19 people will be working at each well, depending on where the drilling is taking place (as few as three people at nonhazardous, nonradioactive sites, and as many as 19 at hazardous-radioactive sites). A cable-tool drilling rig, six to eight trailers, and various other small vehicles will be located on the site. A drill pad will be used to provide a solid, level, clean work area, free of surface contamination. The maximum dimensions for the pad are 10 m^2 (100 ft^2). Depending on the location of the drill site, a road may be constructed to obtain access. These 3- to 3.6-m (10- to 12-ft) wide roads are usually scraped and gravel is placed on top. If numerous borings are needed, a 2,090-m^2 (22,500-ft^2) storage area may also be built, as well as a 2,090-m^2 (22,500-ft^2) central site (for support and lunch trailers). Each well can take 2 weeks to 3 months to drill, depending on the depth of the well, the type of conditions, and the number of chemical samples required. A 0.4-m^2 (4-ft^2) cement pad with a brass well marker will be left in place upon completion of the well.

3.3 VARIOUS OTHER INVESTIGATIONS

Other types of investigations that may be conducted in the course of characterization activities include air, ecological, and cultural resources investigations. These activities will be conducted depending on the results of previous site investigations.

3.3.1 Air Investigation

This will be minimal in scope, confined to health and safety air monitoring for volatile organic chemicals, radionuclides, and particulates.

3.3.2 Ecological Investigations

Ecological investigations will be conducted to identify possible biotic contaminant transport pathways and evaluate the existing concentrations of contaminants in the biota. These investigations will involve bird, mammal, and vegetation surveys, and limited biotic sampling. These surveys involve two to three people walking transects. Each survey will take approximately 30 days. Vegetation surveys are limited to the growing season; bird surveys will be conducted during the winter and spring breeding/migration times. Mammal surveys can be performed in spring and summer.

3.3.3 Cultural Resources Investigations

A complete cultural resources survey of the reactor areas, plus the land between the reactor areas and the Columbia River, will be conducted. Activities include consultations with Indian elders, site recording and registration, and evaluation of structures from the original Manhattan Project. These activities will involve approximately two people walking the 100 Areas and the land between the reactor areas and the Columbia River. If artifacts are found, a backhoe or hand digging may be used for excavation.

4.0 ACCOUNTS OF ENDANGERED, THREATENED, AND CANDIDATE WILDLIFE SPECIES ON THE HANFORD SITE

Both the Washington Department of Wildlife (WDW) and the U.S. Fish and Wildlife Service (USFWS) have the authority to declare a species as threatened or endangered. Those species listed as state threatened or endangered by the WDW may or may not also be listed by the USFWS as federal threatened or endangered, and vice versa. Each agency has its own laws regarding protection to threatened and endangered species on its list.

The WDW designates endangered, threatened, and sensitive wildlife under WAC 232-12-011. This law also has implications for habitat protection and cooperative land management agreements between the WDW and the landowner. WAC 232-12-001 has the ability to slow or stop county and state building permits and can be used to regulate land use at the local or county level.

The USFWS provides legal protection to threatened and endangered species under the Endangered Species Act of 1973 and Public Law 97-304 (the Endangered Species Act Amendments of 1982). Within 50 CFR 402 are the requirements for federal inter-agency cooperation pertaining to endangered and threatened species. Noncompliance with the Endangered Species legislation can halt a project or result in costly, lengthy delays. The Act, simply put, requires any federal agency about to take action that may impact an endangered or threatened species to consult with the endangered species office of the USFWS. The USFWS will inform the landowner what will be necessary to complete a Biological Assessment. Usually a Biological Assessment requires sufficient information to show that an action (for example, construction project) is not likely to jeopardize the continued existence of listed species or result in adverse modification of critical habitat. Thus, an understanding of a species distribution and habitat use is needed.

The various categories for listing a species are as follows. A threatened species is one that is likely to become endangered in the near future because of various threats to its populations. An endangered species is one that is in danger of extinction or extirpation throughout all or a significant part of its range. A candidate level 1 species is a species for which USFWS has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species. A candidate level 2 species is one for which there is some evidence of vulnerability, but for which there are not enough data to support listing proposals at this time.

This section discusses the biology of state and federally classified endangered or threatened species that may occur on the Hanford Site. Table 4-1 lists all state and federal candidate, threatened, and endangered species. Black terns and northern goshawks, both federally listed candidate species, occur only rarely on the Hanford Site, and are not expected to have the potential to be affected by characterization work. Therefore, they are not discussed in detail.

Federal candidate species, level 2, are treated in this report even though there is no legal requirement under the state or federal endangered species laws. These candidates, however, can easily become listed as threatened or endangered (sometimes within a few days; the last changes were made in January 1992). To avoid project delays should these species be listed later, we have chosen to treat them as though they were listed now. State candidate species are not discussed in this report, because the state candidate selection criteria do not necessarily mean the candidate is going to be upgraded to endangered or threatened status in the very near future. Much work remains to determine the distribution and abundance of the state candidates.

Table 4-1. Threatened, Endangered, and Candidate Wildlife of the Hanford Site.

Species	Status[a]
Peregrine falcon (Falco peregrinus)	FE, SE
Bald eagle (Haliaeetus leucocephalus)	FT, ST
American white pelican (Pelecanus erythrorhynchos)	SE
Sandhill crane (Grus canadensis)	SE
Pygmy rabbit (Brachylagus idahoensis)	FC2, ST
Ferruginous hawk (Buteo regalis)	FC2, ST
Western sage grouse (Centrocercus urophasianus)	FC2, SC
Pacific western big-eared bat (Plecotus townsendii)	FC2, SC
Columbia pebblesnail (Fluminicola columbianus)	FC2, SC
Loggerhead shrike (Lanius ludovicianus)	FC2, SC
Northern goshawk (Lanius ludovicianus)	FC2, SC
Black tern (Chlidonia niger)	FC2

[a]FT - Federal Threatened
FE - Federal Endangered
ST - State Threatened
SE - State Endangered
FC2 - Federal Candidate, Level 2
SC - State Candidate for potential listing as Threatened or Endangered (only included for those species that also have federal listing).

4.1 PEREGRINE FALCON (Falco peregrinus) - STATE AND FEDERAL ENDANGERED

The peregrine falcon is the only raptor in Washington listed as endangered. While the historic information regarding peregrines in Washington is sketchy, at least 12 historical nest sites are known, and it appears the present populations have declined from historical levels. In addition to severe impacts from pesticides, other factors such as shooting and loss of habitat have also contributed to the reduction of peregrines from historical levels. To reverse this downward trend, measures must be taken to protect both nesting and foraging habitat, protect nest sites from disturbance, and continue the ban on the introduction of chlorinated hydrocarbons into the environment.

Observations of peregrines on Hanford are few. This may be related to the species secretive nature and the lack of any systematic surveying for it. The recorded observations are as follows (the subspecies were not identified).

1. March 3, 1983, a peregrine was observed at the Columbia River Shoreline of the 300 Area (Landeen et al. 1991).
2. An immature peregrine was observed chasing rock doves near Coyote Rapids on May 2, 1988.
3. An adult male was observed approximately 0.8 km (0.5 mi) southeast of the Arid Lands Ecology (ALE) headquarters on November 3, 1987.
4. Two peregrine falcons were observed on Island 19, across from the TriCities Branch Campus of Washington State University on March 4, 1985.
5. A peregrine was observed chasing gulls on Island 18, adjacent to the 300 Area, on March 9, 1983.

The peregrine falcon occurs worldwide, with three subspecies occurring in North America. These subspecies (all endangered in Washington) include the tundra or Arctic peregrine, the American, and the Peale's falcon. All are crow-sized birds, with the female up to 1/3 larger than the male. Peregrine falcons are distinguished from other falcons by their black head with dark "moustache" strip extending below the eye. The upper body parts are blue-grey in color, with the underparts light with dark barring. The tail is long and the wings pointed and long, with no difference in the plumage between males and females.

Peregrines generally prefer open county such as marshes, coastal and river shorelines, estuaries, wide meadows, and farmlands. These types of habitat suit their style of hunting, which requires long sight distances. Peregrines feed on a variety of songbirds, shorebirds, and waterfowl. When they sight their prey, peregrines are able to dive several hundred feet in the air at speeds up to 200 mi/h to capture their prey on the wing. In some portions of their range, birds may forage up to 16 km (10 mi) or more.

Peregrines prefer to nest on cliff faces in undisturbed areas. In addition, these birds have also been known to nest on river banks, abandoned raptor nests, buildings, and bridge abutments. Rather than build a nest, they form a shallow depression or scrape in which to lay three to four eggs in the spring of the year.

During at least a portion of the year, all three North American peregrine subspecies occur in Washington. During the fall and spring, the tundra peregrine is seen migrating along the coast. The American subspecies winters and breeds on both the east and west side of the Cascade Mountains and along the coast of Washington and inland river valleys. While the Peale's and American falcons were at one time more numerous in Washington, they are now rare. Peale's falcon breeds along the coast of Washington and near shore islands and also winters along the coast.

4.2 BALD EAGLE (Haliaeetus leucocephalus) - STATE AND FEDERAL THREATENED

The bald eagle is federally listed as threatened in five of the lower 48 states, including Washington, and endangered in the other 43. Within Washington, eagles breed primarily west of the Cascade Mountains, with the greatest percentage in San Juan County. A few isolated nests are known to occur on the east side of the state.

The bald eagle is a common wintering raptor at Hanford and has been the subject of much study. Fitzner and Hanson (1979) compared 12 years of bald eagle winter survey data from Hanford, with waterfowl numbers and chinook salmon (Oncorhynchus tschawytscha) redd counts, and provided statistical evidence that eagle numbers in winter varied dependently with salmon redd counts, but not with waterfowl numbers. Eagle numbers increased from a low of four to six eagles wintering at Hanford in the 1960s, to 25 birds in 1979 (Fitzner et al. 1980). Eagle numbers have continued to rise in the 1980s with a maximum count of 55 birds being observed in the winter of 1987-1988 (Gray and Rickard 1989). Table 4-2 shows the numbers of adult and young eagles observed on the Hanford Reach from 1961 to 1990.

Beginning in the late fall, eagles concentrate near water bodies where sizeable fish runs or waterfowl populations are present or, if food such as carrion or rabbits is available, away from water bodies. Bald eagles roost communally during the winter. Day roosts may be along waterways, the birds perching there when not feeding, while night roosts tend to be inland in more protected areas to avoid the elements. Eagles usually construct their nests within 3.2 km (2 mi) and more often within 0.8 km (0.5 mi) of a large water body. These water bodies provide the food resources necessary for the adults to rear their young. Trees where eagles nest must be large enough to support the heavy and bulky stick nests the eagles build. Old-growth Douglas fir or some other dominant tree is normally where eagles construct their nests in Washington. The nests may be placed near the top of the tree and, while the same nest may be used in successive years, several alternative nests are occasionally constructed nearby.

Table 4-2. Maximum Numbers of Adult and Young Eagles on the Hanford Reach, 1961 to 1990[a].

Year	Total	Adults	Juveniles
1961	6	5	1
1962	3	2	1
1963	2	2	0
1964	4	2	2
1965	6	4	2
1966	3	3	0
1967	5	5	0
1968	5	4	1
1969	5	3	2
1970	4	1	3
1971	5	2	3
1972	9	2	7
1973	11	3	8
1974	4	4	0
1975	24	8	16
1976	16	7	9
1977	22	9	13
1978	18	6	12
1979	25	8	17
1980	20	7	13
1981	22	9	13
1982	26	10	16
1983	20	10	10
1984	42	10	32
1985	42	10	32
1986	43	11	32
1987	55	23	32
1988	36	15	21
1989	34	15	19
1990	43	23	20

[a]1990 covers October 1990 through March 1991.

Bald eagles begin courting in February and continue through March, with birds mating for life. On the average, two eggs are laid per breeding season. Depending on human disturbance, prey availability, weather, and environmental contaminants, the birds may not nest every year. Both the male and female incubate the eggs and tend the young. By mid-July, the young are able to fly and forage for themselves.

While historical data for Washington are unreliable, it appears eagles were widespread and abundant in the mid-1800s. Population levels began declining as the state became settled, with bald eagles becoming uncommon to rare by the early 1900s. Since 1978, bald eagles appear to be gradually recovering to pre-1900 levels. As of 1985 there were 290 known bald eagle territories in Washington. Washington is also a very important wintering area, with the highest densities of eagles in the northwest portion of the state.

Factors contributing to the decline of bald eagles throughout North America include the presence of chlorinated hydrocarbons (i.e., DDT, DDE) in the environment, loss of habitat, a reduction in food supply, electrocution, and shooting. For the species to recover, the eagle's habitat must be preserved and protected, including nest trees, roost trees, foraging areas, and wintering areas.

The winter habitat used by the bald eagle on the Hanford Site includes perch sites, night roosts, and foraging areas. Eagles have also constructed nests at the Hanford Site; however, these nests have been unsuccessful to date. These activities are discussed in the following sections.

4.2.1 Perch Sites

During daylight hours, bald eagles perch along the Hanford Reach and also use inland areas within a few kilometers of the river. The primary perching areas occur from the Hanford Townsite upstream to Vernita Bridge. All trees provide perching. The White Bluffs opposite the 100-D and 100-H Areas are also used for daytime perching. Figure 4-1 shows the primary perching areas on the Hanford Site.

4.2.2 Night Roosts

Three primary night roosts exist in a few of the larger groves of trees on Hanford and numerous secondary roosts exist in smaller groves and single trees. An important communal night roost consisting of a group of decadent black locust (Robinia pseudo-acacia) and living white poplars (Populus alba) occurs on the White Bluffs peninsula (Figure 4-2). This grove of trees is also the site of a great blue heron (Ardea herodias) nesting colony. In the winter, the herons move away from the nesting colony and their abandoned nests and nesting trees serve as perches for the night-roosting eagles. Late-evening surveys have shown that as many as 25 eagles have used this site as a communal night roost.

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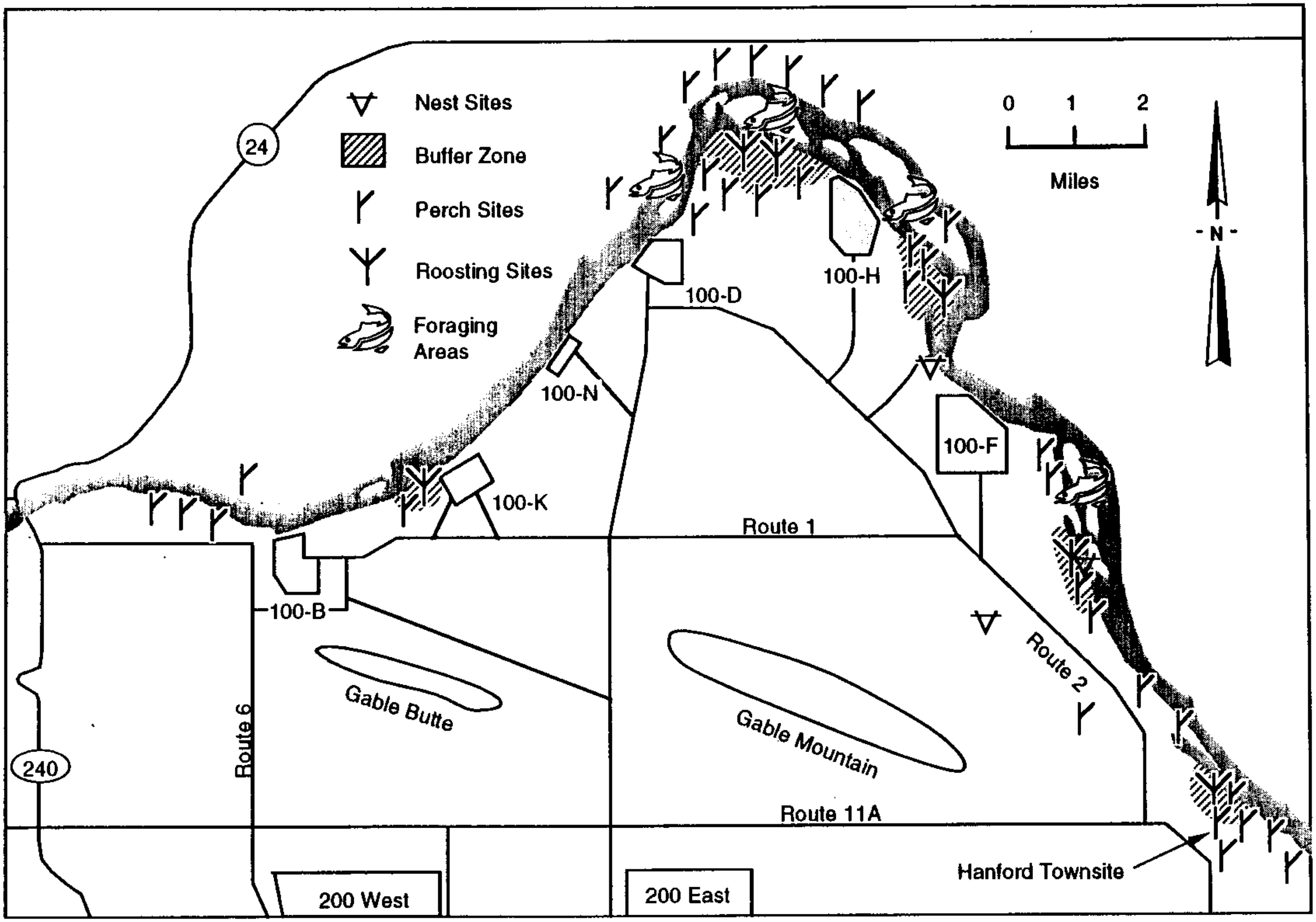

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Figure 4-1. Bald Eagle Perching Areas on the Hanford Site.

Figure 4-2. Bald Eagle Roost on White Bluffs Peninsula.

Two other major roosting sites can be found along the Benton County bank of the Columbia River between the 100-D and 100-H Areas (in Section 12, Township 14N, Range 26E, see Figure 4-1). These roosting areas are very similar, being in tall, old black locust trees (Figure 4-3). These roosting sites are within 500 m (1,640 ft) of one another, and birds often move back and forth between them.

Secondary roosting sites are used by one, two, or three eagles. One such roosting area is located immediately adjacent to the 100-K Area, on the bank of the Columbia River. Two adult eagles have been seen using this site for roosting since the mid-1980s. Figure 4-4 shows an aerial view of this site. Another roosting site has been noted in another heron nesting colony below the 100-F Area (Figure 4-1). This roost is in a grove of black locust trees situated on the bank of the river, in Section 10, Township 13N, Range 27E. Up to six birds have been observed using this site for a night roost. A third roosting area is located north of the Hanford Townsite. This roost is in a tall Siberian elm (Ulmus pumila) situated along the bank of the Columbia River. One or two roosting eagles have occasionally been observed here. Other trees and the steep bluffs adjacent to Locke Island are also sometimes used by eagles as roosting sites.

Figure 4-3. Bald Eagle Roost Between 100-D and 100-H Areas.

Figure 4-4. Bald Eagle Roost at the 100-K Area.

4.2.3 Foraging Areas

Bald eagles forage throughout the Hanford Reach, but most of their foraging is done from the Hanford Townsite upstream to the abandoned 100-B Reactor. This area contains 10 islands and a variety of shoreline habitats. The primary spawning grounds of the chinook salmon on Hanford also occur through this area (Dauble and Watson 1990). This area is also closed to hunting and is not heavily used by recreationists during the winter months. This seclusion from human disturbance is likely a major attractant to the eagles (Fitzner et al. 1980).

4.2.4 Nesting Areas

Bald eagles have been observed building nests at Hanford, but, to date, none have produced young. The reasons for nest failure are uncertain, but may be related to human disturbance during nest building and/or egg laying, and/or natural phenomena (i.e., prey base, weather). In 1991, two nests were constructed, one in Section 29, Township 14N, Range 27E, at the White Bluffs boat ramp. The second nest was constructed in Section 9, Township 13N, Range 27E. In 1992, another nest was constructed in Section 10, Township 13N, Range 27E. To our knowledge, no eggs were laid. All nests appeared to be fully constructed, and the nest bowls were lined with fine material.

4.3 AMERICAN WHITE PELICAN (Pelecanus erythrorhynchos) - STATE ENDANGERED, NOT FEDERALLY LISTED FOR WASHINGTON STATE

Pelicans are surveyed along the Hanford Reach during the annual bald eagle surveys, and several surveys were also conducted during the summers of 1990 and 1991 by R. E. Fitzner. These surveys have shown that the white pelican is a winter resident along the Hanford Reach of the Columbia River. For over two decades, a small flock of 10 to 12 birds has wintered between Ringold and the Vernita Bridge, foraging for scrap fish (carp, suckers). During the summer of 1989, nearly 300 pelicans frequented the Hanford Reach. These birds are believed to have been part of a nesting colony that failed near Stillwater, Nevada. Other sources could have been from birds previously using the lakes of Klamath and Lake counties in southern Oregon.

Although the number of white pelicans found in Washington State was never large, regular breeding pairs were commonly found until the early part of this century. The last confirmed nesting site was in the Moses Lake Potholes area in 1926. At present, the only pelicans found in Washington are nonbreeders. During the summer, flocks of 30 to 40 birds are commonly seen throughout the Columbia Basin. In the spring and fall, migrating birds pass through the Basin, with birds over-wintering on the Snake and Columbia rivers.

The primary reason for the decline from breeders to nonbreeders and an overall decline in numbers is attributed to a loss of habitat from land reclamation and irrigation projects. Other factors include shooting during migration, destruction of existing breeding colonies, and harassment by recreationists. It appears to be feasible to reestablish white pelicans in Washington, with the Columbia Basin the most likely area where habitat requirements could be met.

Pelicans concentrate around the 100-F Area slough and around the islands from the White Bluffs boat ramp upstream to the 100-D Area. The islands are afforded protection currently, because of their use by nesting Canada geese. Extending protection of the islands for nesting by pelicans would have little impact on existing operations at Hanford because the birds spend the majority of their life activities in and around the water. They do not venture onto drylands to forage and would not impact operations centered on the mainland. The most likely islands that may be acceptable for nesting to pelicans would be Islands 1, 2, or 3 (Figure 2-1). Currently, the USFWS is experimenting with reintroducing nesting white pelicans to Washington State. Island 2 on the Hanford Reach (Hanson and Eberhardt 1971) has been selected for the placement of pelican decoys. These decoys may attract pelicans and introduce them to nest activity.

During the nesting season, the birds seek out isolated islands or gravel bars to avoid human disturbance. Nest sites must be located near foraging areas (e.g., shallow water bodies or marshy areas). The birds nest in colonies, with the individual nest usually located in an unlined, shallow depression in the ground. An average of two eggs are laid, and both adults incubate the eggs. During the remainder of the year, they will roost on islands within large bodies of freshwater. They may be found during migration in other waterbodies (such as estuaries, coastal bays, and inlets) in salt or brackish waters. While other pelicans may dive for food, white pelicans feed from the water surface, often in groups. They may feed on a variety of fish, amphibians, and crustaceans.

4.4 SANDHILL CRANE (Grus canadensis) - STATE ENDANGERED, NOT FEDERALLY LISTED FOR WASHINGTON STATE

Numerous observations have been made of sandhill crane flocks passing over the Hanford Site from late September through early October and again in mid-March through April. However, few observations have been made of birds landing on the Site. Fitzner and Rickard (1975) sighted six individuals at REDOX Pond (decommissioned in 1973) on October 5, 1972. These birds were believed to be greater sandhill cranes (Grus canadensis tabida). On October 11, 1990, seven sandhill cranes were observed on the upper end of Island 19 (Figure 2-1).

On April 1, 1991, nineteen sandhill cranes were observed walking about and feeding on the upper end of Locke Island (Figure 2-1). These birds were identified as greater sandhill cranes.

By 1941, nesting sandhill cranes were eliminated in Washington. Today, lesser sandhill cranes can be seen in the state during the spring and fall migration. Greater sandhill cranes are also found in the state during the migration period, but in lower numbers. The only known nesting cranes are on Conboy National Wildlife Refuge in southcentral Washington. These birds have been nesting there since 1975, but breeding success has been low. There is a possibility that sandhill cranes are nesting on the higher elevation meadows of the Yakima Indian Reservation, but this has yet to be confirmed.

Sandhill cranes generally prefer open habitats such as prairies, grain-fields, shallow lakes, marshes, and ponds. During the breeding season they nest in the drier parts of grassy/marshy areas. Open, flat areas such as shallow lakes or ponds serve as traditional staging areas during migration and the remainder of the year. Forage includes frogs, small fish, crustaceans, insects, small birds, small mammals, berries, and grains.

Habitat loss, illegal shooting, and collisions with power lines appear to be the primary factors in their decline. Heavy predation on eggs in some areas has also contributed to the reduction. The birds are very habitat-specific and do not adjust well to alterations in their environment. Recovery efforts have been somewhat successful, but only in areas where the birds and their habitat have been afforded protection. Future management of this species will focus on finding and protecting isolated open areas the birds require for staging and breeding.

4.5 PYGMY RABBIT (Sylvilagus idahoensis) - STATE THREATENED, FEDERAL CANDIDATE

This small lagomorph is extremely rare in Washington, occurring in the Great Basin portion of the Lower Columbia Basin. The only confirmed population occurs in parts of Douglas County. A pygmy rabbit colony was last observed on the Hanford Site in 1984 before a large fire burned off much of the sagebrush on the Site. Before then, a small population of pygmy rabbits inhabited a dense stand of sagebrush (several hundred hectares) at the 800-m (0.5-mi) level on Rattlesnake Mountain, above Snively Springs. In 1985, after the fire, the rabbits could not be found. There has been no other confirmed documentation of this small lagomorph on the Hanford Site. However, as of October 1992, PNL has begun a census of pygmy rabbits to determine their presence on Hanford.

Pygmy rabbits are relatively slow and vulnerable in open habitats (Weiss and Verts 1984) and seem reluctant to cross extensive open areas (Bradfield 1974). This makes populations very susceptible to isolation because of the fragmentation of habitat.

The pygmy rabbit is restricted to dense stands of big sagebrush on deep soils (Orr 1940; Weiss and Verts 1984). Sagebrush is also an important food of this rabbit, especially in winter (Fisher 1979; Green 1978; Wilde 1978). Burrows are constructed in loose soils, usually on the lee side of a hill (Wilde 1978). Pygmy rabbits are the only rabbits in the northwest that excavate their own burrows; however, they may use the burrows of marmots and badgers. The burrows provide a safe haven to raise young, as well as protection from predators and severe weather (Bradfield 1974). To burrow, the rabbits require deep, workable soils of low soil strength (Weiss and Verts 1984).

4.6 FERRUGINOUS HAWK (Buteo regalis) - STATE THREATENED, FEDERAL CANDIDATE

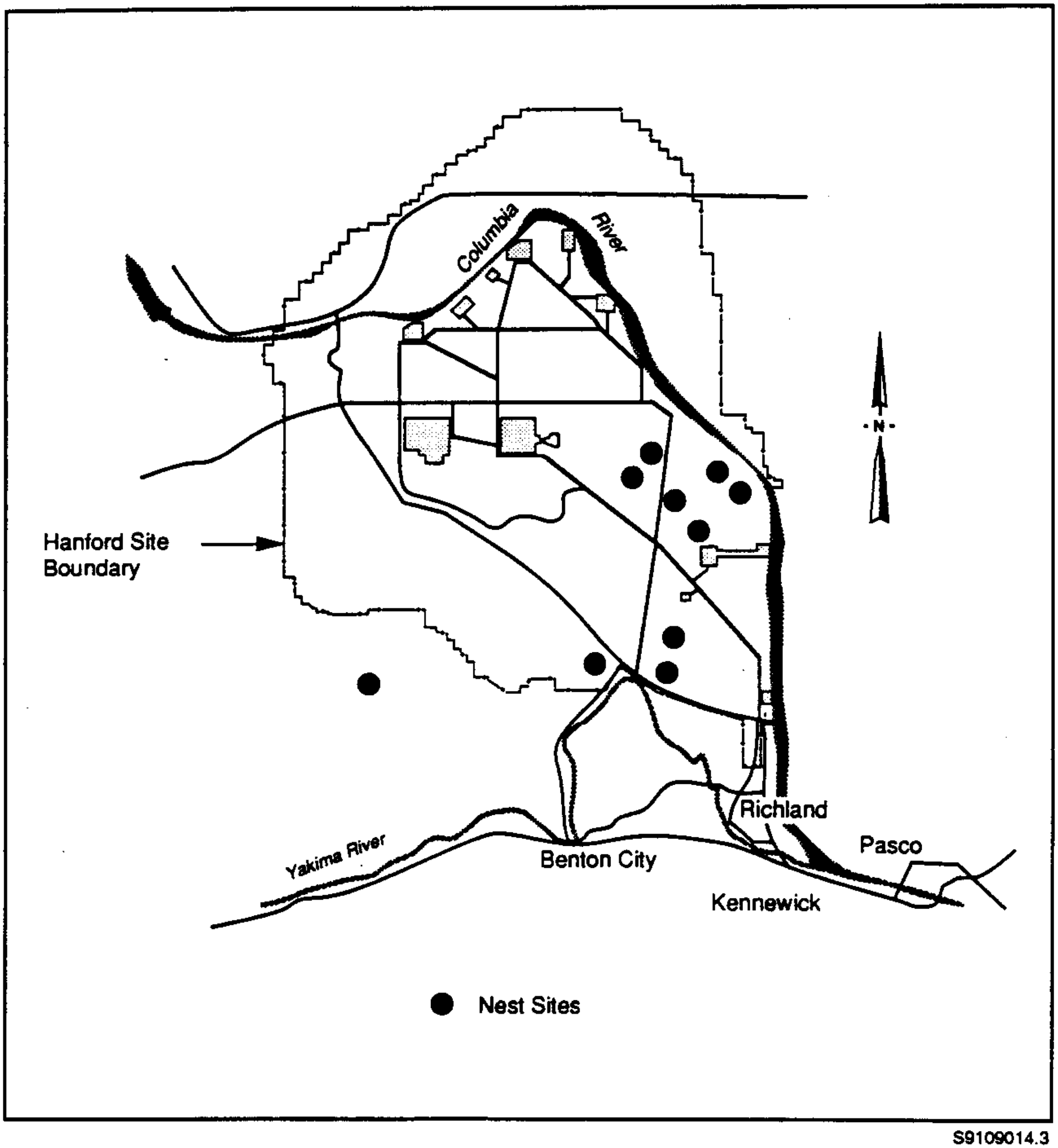
The ferruginous hawk was uncommon at Hanford before 1988. In 1988, surveys showed an increase in nesting attempts by this species (Fitzner and Newell 1989). Eight nests were located that year, seven in transmission towers. Five nests were found in 1989, four in transmission towers. In 1990, nine nests were found on Hanford. In 1991, ten nests were observed, with eight being situated in transmission towers and two in trees. Figure 4-5 shows the location of these nests. Transmission towers had not been reported previously as nesting substrate for ferruginous hawks in Washington (Fitzner and Newell 1989).

These birds nest in the open country of the Canadian prairie provinces south to Oregon, Nevada, Arizona, and Oklahoma. They avoid human disturbance during nesting, preferring rocky outcrops or scattered trees in the open prairies and sagebrush plains. Within Washington, the birds are primarily summer residents, rarely wintering here. The birds prey on small mammals such as hares, rabbits, and rodents, and an occasional bird or reptile. Highest levels of foraging activity occur just before dawn and just after sunset, with birds hunting from the ground, air, or a perch.

Arrival in Washington begins in early spring when migrating birds begin to nest in the arid shrub-steppe habitat of Adams, Benton, Columbia, Franklin, Lincoln, and Walla Walla counties. The majority of ferruginous hawk nests in Washington are in Franklin County. Nests are built in early March on small cliffs, rocky outcrops, or occasionally in juniper (Juniperus occidentalis) trees. The nests are made of sticks and are often lined with cow or horse dung and are often used again in successive years. The eggs are laid in early April, with the young hatching in late April or early May. The female does the majority of the incubating. Ferruginous hawks are highly likely to desert the nests if disturbed by humans. In western North America, breeding success of the ferruginous hawk appears to be closely linked to mammal populations. In one area the annual production varied between 0.6 and 3.0 young per pair, depending on the abundance of black-tailed jackrabbits, while in another area, when jackrabbit numbers declined 79% over a period of 1 year, there was a corresponding 47% reduction in breeding success of hawks (Newton 1979).

Because of their limited abundance, the ferruginous hawk was most likely never abundant in Washington; however, at one time they were common in localized areas. With only 50 actively breeding pairs in the state, the hawk is considered a rare and uncommon eastside resident and a rare breeder in Washington. The population is currently thought to have stabilized at a reduced level.

Figure 4-5. Location of Ferruginous Hawk Nests on the Hanford Site, 1991.



Loss of habitat is the primary factor affecting the ferruginous hawk population in Washington. With the advent of irrigation, the majority of the arid, shrub-steppe habitat in eastern Washington continues to be converted to agricultural use. Off-road vehicle use has impacted some of the juniper forest areas [32 km (20 mi) east of Pasco, Franklin County], while overgrazing is a problem in other areas. Habitat degradation also affects the ferruginous hawk's prey base, in turn affecting hawk population numbers. While the ferruginous hawk will tolerate some alterations to its habitat (e.g., they will nest on power poles, introduced trees, or haystacks), they will not tolerate any close association with humans during the breeding season.

Future status of this species remains uncertain because of the continuing loss of shrub-steppe habitat. To rebuild the ferruginous hawk nesting population in Washington, this habitat must be preserved and nest sites protected from human disturbance.

4.7 WESTERN SAGE GROUSE (Centrocercus urophasianus) - FEDERAL AND STATE CANDIDATE

Currently, sage grouse are found only at upper elevations of Rattlesnake Mountain. Their numbers are low, with only one or two birds observed annually. A female and brood were recorded in Snively Canyon (Rotenberry et al. 1979) in spring 1976. No broods have been seen since. The removal of sagebrush habitat from much of the Hanford Site by the 1984 fire has likely affected the distribution of the species on the Site. The sage grouse once occupied the southern and western parts of the Hanford Site, but disappeared by mid-1960. W. H. Radke, Columbia National Wildlife Refuge (NWR), reported observing a small lek on the Saddle Mountain NWR in 1985. Only a few birds were observed at that time. An evaluation of the current suitability of sage grouse habitat on the Hanford Site is under way.

The sage grouse historically occurred throughout the northwestern United States and southern Canada. Today it is found only in parts of Washington, Oregon, Idaho, Montana, Alberta, Saskatchewan, North Dakota, California, Nevada, Utah, Wyoming, Colorado, and Nebraska (Autenrieth 1986). In Washington, it occurs east of the Cascade Mountains in Grant, Douglas, Lincoln, Yakima, Benton, and Kittitas Counties.

Sage grouse require year-round access to sagebrush (Artemisia spp.) for food, nesting, and cover. They move around throughout their home range and utilize different types of habitat according to their annual cycle. Males arrive on their leks (breeding ground) in late February, followed by females a few weeks later. Leks are usually small open sites such as meadows, low-sage zones, roads, grassy swales, cultivated or natural fields, or disturbance areas created by livestock (Call 1979; Call and Maser 1985). These leks usually range from 0.1 to 10 acres in size, but may be as large as 100 acres (Call 1979). The leks are usually located within 1.6 to 3.2 km (1 to 2 mi) of their winter range (Autenrieth 1986).

Sage grouse begin egg laying about mid-April and may continue until mid-May. Hatching usually occurs from the last week of May through July. The hen usually constructs her nest beneath or between sagebrush plants, usually within 3.2 km (2 mi) of a lek. Nests in sagebrush stands with 20% to 40% canopy cover and 60-cm (24-in.) height, with residual grass cover, have the greatest success (Autenrieth 1986; Call and Maser 1985).

Juvenile sage grouse survival is higher in areas with good sagebrush-grass production and where forbs are a common component of the spring range. The broods move less in these areas, reducing exposure to predators and conserving energy. Insects, especially beetles and ants, are important foods for young sage grouse. Succulent forbs become important as food for maturing chicks (Connelly et al. 1988).

When spring and summer ranges dry, the sage grouse will move to wet areas that support forbs (Autenrieth 1986; Connelly et al. 1988). Low-elevation native or irrigated meadows, stream bottoms, or high-elevation drainages and meadows may be selected (Call and Maser 1985). Sparse, low-growing sagebrush stands located within 3.2 km (2 mi) of feeding sites are used for cover and roosting (Patterson 1952). During winter, sage grouse switch from meadows and drainages to stands of sagebrush. They feed almost entirely on the leaves of sagebrush for food during the winter. Areas with the greatest canopy cover receive the most use in winter. Canopy coverage of at least 15% is apparently required by the grouse for winter habitat (Call and Maser 1985).

4.8 PACIFIC WESTERN BIG-EARED BAT (Plecotis townsendii) - FEDERAL AND STATE CANDIDATE

The Pacific Western Big-eared bat has not been reported at Hanford, but it has also never been looked for. A similar species, the pallid bat (Antrozous pallidus), was also undiscovered before 1978, when a large nursery colony was found in the 100-F Reactor building. Other reactor buildings along the Columbia River may also provide suitable roosting areas for several species of bat.

This small bat occurs in the western United States, central Appalachians, Ozarks, and northern Mexico. In Washington, the species occurs both east and west of the Cascade Mountain range (Larrison 1970). The bat is usually associated with the Sonoran Life Zone (Ingles 1965). The species frequents caves, lava tubes, and abandoned buildings.

4.9 COLUMBIA PEBBLESNAIL (Fluminicola columbiana) - FEDERAL AND STATE CANDIDATE

The Columbia pebblesnail (a gastropod mollusk) has a whorled shell and is about 6 mm (.24 in.) high. Four to five whorls are typical of the species. At present, there are only two remaining sizeable populations of the Columbia pebblesnail: in the Methow and Okanogan rivers in Washington. Smaller populations survive in the Hanford Reach and the lower Salmon River, Idaho, and possibly in the middle Snake River, Idaho, and Grande Ronde, Oregon.

Historically, Columbia pebblesnails occurred in Columbia River tributaries from northwestern Montana to tributaries near the mouth. Today, nearly 100 dams impound waters of the Columbia River Basin and its tributaries, rendering many stream reaches unsuitable as snail habitat. Not all loss of mollusks habitat is attributable to dam impoundment; other stream alterations occurred with irrigation, flood control, logging, grazing, and farming practices that added to erosion and siltation. Surveys of Columbia River Basin streams during the late-1980s indicate pebblesnails are found in limited reaches of about 5 to 10 streams throughout the Basin.

Taylor (1982b, 1985) regards the pebblesnail as particularly characteristic of large rivers and rapids habitat. Our findings necessitate modification of this characterization. Certainly, this pebblesnail does not occupy the wide range of habitats utilized by the closely related F. hindsi, which occupies springs and streams of all sizes with permanent flow and sufficient oxygenation. While absent from springs, the Columbia pebblesnail can thrive in small rivers such as the Methow located in northeast Washington. It is most common at rapids edges or immediately downstream from whitewater areas, and becomes much less common or absent in major rapids. It occupies areas with sufficient flow, oxygenation, and stable substrate even in the absence of rapids or whitewater areas. In most streams, the species originally existed (before human modification) as a single continuous population occupying suitable habitat bands parallel to shore on both sides of the stream. The Columbia pebblesnail avoids lakes, areas of slow flow, areas with mud or silt substrate, areas with bare bedrock substrate, stream reaches with unstable substrate such as rivers with high gradients, streams with glacial flour, and the central deep areas in strong channelized streams. Current populations have been segmented by human modification of streams, including dams and impoundments and increased siltation from grazing and agriculture.

The Columbia pebblesnail, like many other gastropod mollusks, has about a 1-year life cycle. Egg deposition occurs during the spring as water temperatures rise. Growth of young pebblesnails is most rapid during the summer and early fall.

4.10 LOGGERHEAD SHRIKE (Lanius ludovicianus) - FEDERAL AND STATE CANDIDATE

This species breeds in central and northcentral Washington, wintering in north to northwestern Washington. On the Hanford Site, it builds its nest in sagebrush and in trees planted by early settlers (now near abandoned homesites and farms). Once a nest site has been established, it may be occupied for many years (Porter et al. 1975). Poole (1992) conducted her Master's research on Hanford and reported over 100 active nests on the Site.

A limiting factor contributing to the decline of the species over its historical range is the availability of grassland habitats with nest trees or shrubs that offer perch sites and cover from predators (WDW 1992). The conversion of native shrub-steppe habitat to agriculture may affect shrikes, which utilize suitable nest sites in shrub-steppe areas more frequently than in cultivated areas (Porter et al. 1975). Agriculture also reduces vertebrate and invertebrate prey availability to shrikes. Herbicides and pesticides may also affect shrike populations by causing toxicosis and death, and sublethal levels can interfere with normal development and behavior (Busbee 1977). Pesticides can also reduce prey availability to the shrikes. Pesticides and herbicides should not be applied to areas where loggerhead shrikes nest or forage. Chemical spraying should also be avoided where it might drift into shrike habitat (WDW 1992).

4.11 NORTHERN GOSHAWK (Accipiter gentilis) - FEDERAL AND STATE CANDIDATE

Goshawks breed mostly in dense stands of old growth conifers and favor north-facing slopes. They do not nest on the Hanford Site, but have been rarely found wintering around Rattlesnake Springs and in shrub-steppe habitat on the ALE Reserve (Fitzner and Rickard 1975).

Winter habitat has not been studied to any extent in the northwest. The migratory habits of this species are also poorly understood. It would be safe to say, however, that heavy cover associated with riparian areas provides suitable winter habitat for the species.

4.12 BLACK TERN (Chlidonia niger) - FEDERAL CANDIDATE

This is a rare species on the Hanford Site, but is reported elsewhere along the Columbia River near the Tri-Cities (Ennor 1991). This species could also occur around West Lake and B Pond, where bullrushes provide nesting habitat. However, no nesting attempts have been reported for Hanford.

5.0 EFFECTS OF HUMAN DISTURBANCE ON ENDANGERED AND THREATENED SPECIES: VIEWS OF EXPERTS

This section discusses the views of experts related to the effects of human disturbance on those threatened, endangered, and candidate species that reside on the Hanford Site. For each species, a discussion of known effects of disturbance is presented.

5.1 PEREGRINE FALCON

The only disturbance information for peregrine falcons relates to the nesting season. Because no nests have been documented for Hanford, the following information is included to indicate the general sensitivity of this raptor to humans. Also, should nests be found in the future, precautions contained herein should be considered.

Peregrine falcons are sensitive to disturbance during all phases of the nesting season (Hoover and Wills 1987; Pacific Coast Peregrine Falcon Recovery Team 1982). Activities occurring above their nests are more likely to disturb them. Thus, human access along cliff lines should be restricted within 800 m (0.5 mi) of the nest from March through the end of June. Human activities on the face of the nest cliff, or immediately below the nest, should be restricted to within 400 m (0.25 mi) of the nest during this time. Cliff tops above nests should remain undeveloped.

Fyfe and Olendorff (1976) recommend aircraft approach no closer than 450 m (1,476 ft) above the nests. Where possible, power lines should be routed away from aeries (Olsen and Olsen 1980).

5.2 BALD EAGLE

Much research has been conducted on the effects of human disturbance on bald eagles. Anthony et al. (1982), Knight and Knight (1984), and Stalmaster and Newman (1978) conducted specific studies that were designed to analyze the effects of humans on bald eagles, providing wealth of data. Anthony et al. (1982) found that human activities around eagle nest trees during the nesting season can disturb eagles and cause nest abandonment or reduced reproductive success. Grubb (1976, 1980) found productive bald eagle nests were farther from human activity, an average of at least 120 m (394 ft), than were unproductive nests. The author points out this value is similar to the U.S. Forest Service criteria, which prohibits activity within 100 m (328 ft) of nests and allows only minor activity within 200 m (656 ft) during the nonbreeding season (Mathisen et al. 1977).

Fraser et al. (1983) found eagle nests were farther from the shoreline in developed areas and farther from clusters of houses than from random points. They also found that 79% of eagles flushed from the nest at the approach of a pedestrian within 300 m (984 ft). Stalmaster (1976) and Servheen (1975) found that eagles consistently used the river bank with the least human activity. Eagles avoid areas of human activity (e.g., campgrounds and housing developments). Steenhof (1976) noted 80 cars per day passing within 34 m (112 ft) of an eagle perch with no apparent disruption to the eagles. Airplanes passing over eagles at 30 to 90 m (98 to 295 ft) rarely disturb eagles (Krauss 1977), while boats and snowmobiles are highly disturbing to eagles (Ingram 1965). The sound of gunshots usually cause an eagle to leave an area, and chainsaw activity within 1.2 km (0.75 mi) has driven eagles from a Wisconsin roost (Steenhof 1976).

Knight and Knight (1984) documented the responses of wintering bald eagles to boating activity on the Nooksack and Skagit rivers. They found when eagles were perched in trees above the river, a buffer distance of 350 m (1,148 ft) would protect (not result in a flush response) 90% of the birds, while 90% of those eagles on the ground would not flush if the researchers stayed at least 450 m (1,476 ft) away. Boating has been found to be very disturbing to foraging eagles on the lower Columbia River (McGarigal et al. 1991; Watson et al. 1991).

Stalmaster and Newman (1978) also documented the behavioral responses of wintering bald eagles to human activity. They found feeding birds were sensitive to human disturbance, and a significant difference was noted in tolerance of adults and juveniles to human activity. Adults were almost always more sensitive and preferred areas of low human activity. The sound of gunshots was highly disruptive, while noises were not as disruptive. Adults were more tolerant of human activity when vegetation buffered the eagles's line-of-sight to an activity. Vegetation buffer zones were recommended as an effective means to reduce disruption. They recommended a buffer zone of 250 m (820 ft) in open country around perched eagles. Stalmaster (1980) later reported this distance could be shortened to 75 to 100 m (246 to 328 ft) if at least 50 m (164 ft) of this contained dense, shielding vegetation.

Anthony and Isaacs (1989) recommended that habitat alterations not occur within 400 m (0.25 mi) of nests and that disturbing activities within 800 m (0.5 mi) should be restricted from January 1 to August 31. These distances are based on their research and that of Harris (1984). The USFWS Pacific Bald Eagle Recovery Plan recommends establishing buffer zones around individual nest areas and excluding logging, construction, habitat improvement, and other activities during critical periods of eagle use. Picnicking, camping, blasting, using firearms, harvesting timber, and operating aircraft at low levels should not be allowed within 400 m (0.25 mi) of nests and roosts during periods of eagle use. These activities should be regulated up to 800 m (0.5 mi) from nests and roosts where eagles have line-of-sight throughout the recovery area but generally fall between January 1 and August 31. Key wintering areas need protection from disturbance from approximately November 15 to March 15. Permanent structures that would be occupied during periods of eagle use should not be constructed near nesting or wintering areas. Buildings should be no closer than 400 m (0.25 mi) from the shorelines of feeding waters (USFWS 1986). Washington Department of Wildlife suggests minimizing risks to bald eagle nesting by avoiding activities within buffer zones from January 1 through August 15 and restricting activities in roosting areas from November 1 through April 1. In feeding areas, they recommend leaving strips of tall perch trees from 50 to 100 m (164 to 328 ft) wide along the shorelines of major feeding areas and, where little screening material is available, establishing buffer zones of 250 to 300 m (820 to 984 ft) (similar to recommendations by Stalmaster 1987). Recommendations for buffer zone sizes and temporal restrictions to minimize human disturbances on Hanford closely follow the above suggestions and findings. Temporal restrictions are slightly different, with October 15 to April 1 being the time when eagles winter on the Site. January 1 to July 15 is recommended as the critical time for nesting (Fitzner and Weiss 1992).

5.3 AMERICAN WHITE PELICAN

White pelicans do not nest in the state of Washington, but the Hanford Site does provide islands that may be suitable for the species reintroduction into the state. Also, recent increases in white pelican use of the Hanford Site provide hope that this species may soon begin nesting in the region. Shoul that happen, the recommendations given here should be adhered to, so that the pelican can be provided with an undisturbed environment conducive to nesting.

Perhaps the most limiting factor to white pelicans in Washington is nest failure caused from unintentional harassment (USFWS 1984; WDW 1991). Within Washington, isolated, secure, and unvisited islands are rare; consequently, breeding populations of pelicans are not found in the state. The USFWS (1984) recommends that potential nesting islands be at least 1.4 acre in size, with 1 acre or larger islands being preferred.

Nesting white pelicans are very sensitive to human disturbance and need a buffer zone of 400 to 800 m (0.25 to 0.50 mi) closed to all human activity (WDW 1991). The critical nesting period is from March 15 to August 31, and human activities should be restricted during this time. Recreational activities such as boating should be regulated in pelican breeding and nesting areas, and boat launches should not be constructed near nesting sites. Aircraft should not be allowed to fly within 600 m (1,968 ft) of a pelican colony.

5.4 SANDHILL CRANE

Much of the developed portions of the Hanford Site in Benton County do not provide nesting areas suitable for the sandhill crane. The Saddle Mountain National Wildlife Refuge and the Wahluke Slope Wildlife Recreation Area in Franklin and Grant Counties do contain wetlands that could serve as nesting sites for this species. Sandhill cranes do utilize islands in the Hanford Reach for feeding and loafing during migration.

All new construction or traffic increases should be avoided within 800 m (0.50 mi) of feeding areas (WDW 1991). Sandhill cranes have only been reported feeding near islands in the Columbia River on the Hanford Site; thus, characterization activities will likely have no impact on this species.

5.5 PYGMY RABBIT

Activities that alter native habitats of sagebrush, bluebunch wheatgrass (Agropyron spicatum), and bluegrass (Poa spp.) should be avoided in potential pygmy rabbit range. Grazing of pygmy rabbit habitat should be avoided, and all practices that damage sagebrush such as bulldozing or spraying of herbicides should also be avoided. Corridors of sagebrush habitat should be left or allowed to return between known and historical pygmy rabbit colonies (WDW 1991). Land-use practices that alter soils or threaten burrows through plowing, bulldozing, or heavy livestock grazing should be avoided. Prevention of wildfires by limiting off-road vehicle traffic in potential pygmy rabbit habitat during the fire season should be initiated.

5.6 FERRUGINOUS HAWK

Gilmer and Stewart (1983) found that the distribution of ferruginous hawk nests suggested that land-use patterns influenced habitat selection by this species. Land use within 100 m (328 ft) of nests situated on the ground was undeveloped pasture. Land use within 1 km (0.62 mi) of nests in trees was 76.5% pasture and haylands, while land use within 1 km (0.62 mi) of ground nests was 94.8% pasture and haylands. From these findings, the authors suggested tree-nesting hawks were more tolerant of activity than were ground-nesting hawks, and nesting appeared to be done in areas of low human activity. Few pairs nested in areas where 75% of the land was in cultivation.

Using various controlled disturbances, White and Thurow (1985) quantified the levels of disturbance and the size of the buffer zones needed to maintain nesting success and productivity of undisturbed hawks. Disturbance methods included 1) approach on foot, 2) approach in a vehicle, 3) continuous operation of a 3.5-hp gasoline engine near the nest, and 4) firing of a 0.22 caliber rifle every 20 m (66 ft) approaching from 500 m (1,640 ft) or using a sound-producing device (80 dB) 30 to 50 m (98 to 164 ft) from the nest, which represented common noise at a construction site. The investigators would approach only until the bird flushed and then leave the area immediately. Success of experimental and control nests was determined. This particular study is one of a kind. It is the only controlled disturbance study known for ferruginous hawks and has tremendous management application for this and other buteo hawks.

The study showed that adults did not flush 60% of the time if the activities were more than 120 m (394 ft) away from the nest and 90% of the time if activities were more than 250 m (820 ft) from nests. None of the disturbance treatments produced significantly different effects on the birds, but their effects were significantly different from those of the control nests ($P < 0.05$). Only 52% of the territories containing disturbed nests ($n=24$) were occupied the subsequent year, while 93% of the territories containing control nests ($n=38$) were occupied the following year. Of the nests where adults flushed, 40% in 1978 and 36% in 1979 resulted in nest desertions. The control nests fledged one more fledgling per nest than disturbed nests. The investigators attributed this to inattendence of the nests by the parents because of their preoccupation with the disturbance.

While concealed noises (no human activity) usually resulted in less disturbance, one test with a concealed noisemaker (100 dB-B weighted), activated as a female hawk returned to the nest, resulted in nest desertion. A female hawk would usually not desert a nest once eggs began to hatch or if there were nestlings present. In addition, food abundance appeared to affect abandonment rate. When food was high and adults healthy, desertion was lower than when food was scarce and adults unhealthy.

Based on White and Thurow's (1985) study, a buffer zone of 250 m (807 ft) is recommended to protect 90% of the nesting adults (see Figure 4-5). This recommendation assumes food is not limited and adults are healthy. If food is limited and/or adults are in poor condition, the buffer zone should be increased accordingly. However, the study was a short-term disturbance where the researchers left the area immediately. Long-term disturbances would significantly alter the desertion rate, because adults tend to reject eggs once they have cooled, and require an increase in the size of buffer zones.

Other researchers (Sullivan 1988) recommend that any development should be at least 200 to 500 m (656 to 1,640 ft) from nest sites and specific development such as drilling should be at least 800 m (0.5 mi) from ferruginous hawk habitats all year and 1.6 km (1.0 mi) from nests from March through July 16. To protect the habitat of the prey of ferruginous hawks, fire prevention measures should be strictly enforced during the fire season.

5.7 WESTERN SAGE GROUSE

The key to saving populations of sage grouse in Washington is the preservation of key habitat, particularly "strutting grounds," nesting areas, and wintering areas. The WDW has established guidelines for those who intend to control sagebrush within the range of the sage grouse. These WDW management recommendations, when applied to Hanford, would indicate that any site management that involves new construction or activities that disrupt sagebrush habitat should be avoided. Characterization activities are not expected to destroy sagebrush and will likely have little impact on this species. Fire prevention measures should be strictly enforced during the fire season.

5.8 PACIFIC WESTERN BIG-EARED BAT

This bat species is extremely sensitive to human disturbance (Graham 1966; Humphrey and Kunz 1976; Pearson et al. 1952). Disturbance can simply mean visiting that portion of a cave or building used by the bats. Following an intrusion, they will readily abandon nursery colonies, leaving with their young at night and travelling to a new site (if one is available). Thus, all visitation to nursery areas should be avoided from May 1 to August 30 (Perkins and Levesque 1987).

At hibernacula, disturbance of the sleeping colony can cause bats to stir, warm themselves, and become active. Such activity may cost them an excessive portion of their limited winter energy reserves. If repeated, it may cause reproductive failure, abandonment of the site, or death from starvation. Therefore, caves and buildings used for hibernation should be closed to people and other sources of disturbance from November 1 to April 1 (Perkins 1985).

Pesticides or herbicides, which could reduce the bat's food resources, should not be applied near the entrances of nursery or roost caves and buildings. Applications of pesticides and herbicides should also be avoided in areas that are likely foraging sites for bats, such as ponds (Perkins and Levesque 1987).

5.9 COLUMBIA PEBBLESNAIL

This species would be negatively impacted by activities that altered water flow or water quality (Taylor 1982). Water pollution may be one factor responsible for the extirpation of the pebblesnail from the Snake River (Taylor 1982). Therefore, activities that could pollute the water should not occur near the Hanford Reach. Characterization activities will not alter aquatic habitats or have any negative impact on this species.

5.10 LOGGERHEAD SHRIKE

This species could be impacted by land-use activities that alter prey availability and nesting habitat. Wildfire, pesticides, herbicides, and other chemicals that could reduce prey, cause mortality to shrikes, destroy the shrub-steppe habitat, or alter their behavior should be carefully managed to eliminate potential problems. Habitat containing nesting and foraging areas should be avoided and left undisturbed.

5.11 NORTHERN GOSHAWK AND BLACK TERN

Because of the rare migratory occurrence of these species on the Hanford Site, they will not be discussed further.

6.0 RECOMMENDATIONS TO MINIMIZE DISTURBANCE ON THREATENED AND ENDANGERED SPECIES

This section discusses recommendations to minimize disturbance of protected species on the Hanford Site during the characterization activities. These recommendations are based on past studies of others on these species (see Section 5.0) and observed effects noted on various species in studies conducted on the Hanford Site. Only those activities with the possibility of an effect are discussed.

Shrub-steppe habitat is extremely important to many species of special concern, such as sage grouse, pygmy rabbits, loggerhead shrikes, and ferruginous hawks. This habitat type has been continually degraded across eastern Washington and on the Hanford Site, and is now a limiting factor for these species. Thus, efforts will continue to be made to minimize the impact on this habitat from CERCLA activities, such as from wildfire and off-road vehicle traffic. However, a careful balance must be made to not destroy habitat unnecessarily in the name of fire protection, such as through large drill pad construction or extra-wide access roads. In addition, upon conclusion of final cleanup actions at sites, native vegetation will be reseeded to restore the shrub-steppe.

6.1 NONINTRUSIVE ACTIVITIES

The nonintrusive activities that could affect protected species are surface radiation surveys, electromagnetic induction/magnetometer surveys, ground-penetrating radar, soil and sediment sampling, soil gas surveys, and surface water and sediment sampling.

Nonintrusive activities will not cause noticeable disruption to vegetation or soils and thus no loss of wildlife habitat will occur. However, potential impacts could result from human presence.

CERCLA investigations do have the potential to increase fire frequencies at Hanford. The sagebrush component of shrub-steppe habitat is especially vulnerable to fire and is slow to recover. Fire can be an extremely important issue when it alters habitats utilized by threatened and endangered species. Efforts are currently made, especially during summer, to minimize the possibility of wildfire.

Section 5.0 of this report describes many instances where the presence of humans near a nest site or use area has caused an impact to an endangered or threatened species. Most wildlife species avoid humans and tend to stay away from areas frequented by humans. There are also critical times in the annual life cycle of each species when human presence is not tolerated. In the case of ferruginous hawks and bald eagles, territory initiation, courtship and egg-laying periods are very sensitive times, when the presence of people within the birds' territory can cause nest desertion.

Some species are more tolerant to human presence than others. Section 5.0 discusses the effects of human presence on each endangered and threatened species treated here. This section provides the recommendations of spatial and temporal restrictions that should be adhered to minimize potential human impacts to sensitive species.

- Bald eagle: Nonintrusive activities should be scheduled to avoid bald eagle communal night roosting and nest sites. These areas are denoted in Figure 4-1. Eagle usage of the sites can range from October 15 to April 1. The nest sites, if occupied, should be strictly avoided from January 1 to May 1 with limited access from May 1 through July 15. On the figure, buffer zones (exclusion zones) have been drawn around roost and nest sites to help in the planning of radiation surveys and other nonintrusive work.

- White pelican: Field crews should avoid those areas where white pelicans rest on islands and along the shoreline of the Columbia River. Most characterization activities are not planned to occur near pelican high use areas.

- Sandhill crane: Sandhill cranes occasionally stop over during migration, with most recent observations being reported on islands in the Columbia River. If these areas are avoided, there should be little conflict with the sandhill crane.

- Pygmy rabbit - Sage grouse: Because the pygmy rabbit and sage grouse are not known to exist anywhere on site outside the Arid Lands Ecology Reserve, conflicts with field work are unlikely. However, large areas of sagebrush should be protected as much as possible to allow for natural reestablishment of these species.

- Ferruginous hawk: All ferruginous hawk nest sites should be avoided by field workers from March 1 through August 1. Workers should not encroach upon a nest any closer than 250 m (820 ft).

6.2 INTRUSIVE ACTIVITIES

6.2.1 Trench and Test Pit Soil Sampling

The pit sampling will likely have effects on threatened or endangered species similar to the nonintrusive activities (Section 6.1). The primary difference relates to the disturbance of soil and surface vegetation. Digging activities may remove habitat for some threatened and endangered species if in undisturbed habitat. Native vegetation disturbance should be kept to a minimum. Any surface areas in which disturbances remove vegetation should be revegetated with native plant species. Temporal restrictions should be placed on this activity when there is a potential for interaction with a threatened or endangered species. Buffer zones discussed in Section 5.0 of this report should be followed.

6.2.2 Borehole and Well Drilling

The borehole and well drilling activities have the greatest potential of all characterization activities for impacting threatened and endangered wildlife on Hanford. Adherence to the temporal restrictions and buffer zone exclusion areas is recommended (see Sections 5.0 and 6.1 of this report). The borehole and well drilling at an individual site will occur over 1- to 3-month period, and will involve noisy equipment, a large number of field personnel, disturbance of land [9.3-m^2 (100-ft^2) storage areas], and road construction. One of these activities by itself could impact a threatened or endangered species. All of them combined have some likelihood of impacting a threatened or endangered species. Special care will be needed by Hanford contractors to schedule borehole and test well drilling around the critical times if endangered and threatened wildlife are identified as being near a planned test site. Because this activity could impact sensitive species, we discuss each threatened and endangered species below. Specific attention is paid to temporal restrictions and potential effects of the proposed action.

- Peregrine falcon: The peregrine falcon would likely not be impacted by this action, because peregrines are migrants through the Hanford Reach and do not nest on the Site.

- Bald eagle: Perch sites, foraging areas and night roosting areas could be impacted by this action in several ways. The high level of noise involved in well drilling can be very disturbing to the eagles. The presence of workers will also disturb the birds. An 800-m (0.5-mi) buffer around the night roosts should be adhered to from October 15 through April 1. Jogging and lunch-time sightseeing should be avoided within the buffer zone (exclusion area).

Nest sites should have an 800-m (0.5-mi) buffer (exclusion) zone placed around them (Fitzner and Weiss 1991). Noise from drilling and human presence would impact nesting birds, likely causing nest desertion. All occupied nest sites should be avoided from January 1 through May 1, with limited access from May 1 through July 15.

- White pelican: Efforts should be made to avoid drilling near the shoreline of the Columbia River, particularly from the White Bluffs boat ramp upstream to the 100-N Area and from the 100-F Area downstream to the Hanford powerline.

  If a drill site does occur nearer to the river than 800 m (0.5 mi), we recommend the following:

  1. Keep workers from the river shoreline, and restrict their activities to the work site.

  2. If pelicans are noted nesting near a proposed drill site or roadway [within 800 m (0.5 mi)], reschedule the action so that it would not interfere with the pelicans nesting season (April 1 through August).

- Sandhill crane: Same recommendations as white pelican.

- Pygmy rabbit-sage grouse: Both of these species depend on extensive, dense stands of sagebrush. The sage grouse could also utilize areas along the Columbia River for foraging. Activities that disturb areas with adequate sagebrush should be surveyed for these species before beginning work. If either species is found near the proposed work site, the site should be relocated. In addition, any such disturbed ground should be reclaimed and planted to native vegetation after the project is completed.

- Ferruginous hawk: This species is very sensitive to human disturbance (see Sections 3.0 and 5.0) and would be impacted by this activity if it were to occur near a nest site. Adherence to the March 1 though August 1 temporal restriction for disturbance minimization and an 250-m (820-ft) buffer zone should provide adequate protection for nesting birds.

  The creation of drill pads, storage areas, and roadways will remove land from productivity and could eliminate foraging areas utilized by this species. Care must be taken to reduce any major land-disturbing activity affecting foraging habitat on the Hanford Site. Impacts to the foraging area can be minimized and/or mitigated by reclaiming the disturbed ground. Removal of the gravel pads and roadways, and revegetation with native plants are recommended.

- Pacific Western big-eared bat: This species is easily disturbed by noise and human presence. Characterization activities that can be detected within a building being utilized by this species should be avoided. However, some buildings have thick walls and drilling even directly adjacent to them will likely not be detectable.

- Loggerhead shrike: Nesting and foraging areas could be impacted by CERCLA intrusive activities in several ways. Noise could be very disturbing to nesting birds; however, little is known about the effects of human presence or noise on this species.

  Removal of habitat could cause a reduction in prey base and nest sites. Over 100 nesting territories are known for the Hanford Site. Locations are listed in a computer data base, and potential conflicts with CERCLA activities can be determined by a surveying an area before any planned activity.

- Northern goshawk and black tern: No impact would result to goshawks or black terns from CERCLA activities. Most of the sightings of goshawks have taken place on the ALE Reserve. There are no sightings of black terns on the Hanford Site, but they are seen during migration along the Columbia River just downstream from Hanford.

6.3 OTHER INVESTIGATIONS

6.3.1 Air Investigations

Impacts to threatened and endangered species from air monitoring is unlikely. Care should be taken, however, to keep any motor-driven monitoring devices away from nesting areas of sensitive wildlife. The temporal restrictions discussed in Sections 5.0, 6.1, and 6.2 apply to any action that would generate noise or require human presence near a threatened or endangered species use area.

6.3.2 Ecological Investigations

Biotic surveys (bird surveys, vegetation surveys) are a necessary part of this Biological Assessment. Care should be taken, however, to avoid disturbing threatened and endangered wildlife. Adhering to recommended buffer zones and temporal restrictions will reduce the chances of any conflicts.

6.3.3 Other Investigations

Cultural resource investigations could have an impact on threatened or endangered species. This work must also adhere to the buffer zones and temporal restrictions.

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